Vertebrate Fauna of Nichol's Hammock, a Natural Trap

Sue E. Hirschfeld

A vast and assorted fossil fauna has been collected from the limestone and phosphate quarries, sinkholes, caves, and rivers of North and Central Florida. Most of these localities are Late Tertiary and Pleistocene in age. Many springs, sinks, and cave entrances now form steep walled natural traps. Some are presently trapping animals in a manner comparable to those which have yielded the fossil faunas. Carcasses of cows, horses, and pigs are often found in these open pits, although most ranchers fence them off to prevent losing their livestock. So much of northern Florida is used for grazing livestock that it is difficult to find a solution hole which has trapped a native fauna. In 1958, such a trap was discovered in Nichol's Hammock, a small jungle hammock near the southern Florida town of Princeton. Several students from the University of Florida collected material from this site over a two year period. In 1964, I went to Nichol's Hammock to collect more material, but I found the hammock leveled and the solution hole filled in. Fortunately enough material had already been collected to be considered a representative sample.

A study of this fauna was undertaken with three main purposes in mind. First, to determine what animals became trapped in a solution hole. Second, using the information on habitat preferences, to determine to what degree the species collected actually reflect the existing environment and the fauna of the surrounding area. Third, turning the problem around and treating the assemblage as if it were a fossil fauna, to see if it is possible to accurately reconstruct the environment on the basis of the species alone.

I wish to express my appreciation to Dr. F. Wayne King and Mr. J. Howard Hutchison, who did the majority of the collecting at Nichol's Hammock and who supplied valuable information about the locality and collecting techniques. I would also like to thank Dr. Walter Auffenberg for his assistance in identifying the reptiles and amphibians, Dr. Pierce Brodkorb for his help in identifying the birds, and Dr. S. David Webb, Dr. William Clemens, and Dr. Donald E. Savage for their critical review of this manuscript.

Area of Study

Nichol's Hammock is a small tropical hammock about two to three acres in size, located in the NE¼, sec. 22, T. 56 S., R. 39 E., Gould's Quadrangle, or about 0.7 miles northeast of Princeton, Dade County, Florida. The plant association consists of gumbo-limbo, poisonwood, pisonia, wild olive, wild coffee, and live oak. Within the hammock were about twenty solution holes formed in the Miami Oölite. The solution hole from which the bones were collected was jug shaped, twelve to fifteen feet deep, ten feet across at the bottom, and had sheer walls curving inward near the top. The floor of the pit was covered with twigs and leaf litter. Water stood in places in the bottom of the pit. The bones were found to be most abundant about eighteen to twenty inches from the surface. By December 1960, the hole had been cleaned out to arm's length beneath the soil surface. Unfortunately, the pit was destroyed before any more material could be collected.

Surrounding Nichol's Hammock is an extensive area of rocky pinelands of predominately Caribbean pine and palmetto. About 0.3 miles to the east of the pine area is a manmade pond dug into the limestone, which contains water all year round. This is the nearest permanent body of fresh water. Due east of the hammock, about 7 miles away, is Biscayne Bay. Ten miles due west of the hammock is the boundary of the Everglades National Park. The elevation of Nichol's Hammock is approximately twelve feet.

Relative Age of the Fauna

Southern Florida is not thought to have emerged from the sea until late in the Pleistocene. Ages calculated from the Th^{230}: U^{234} method indicate marine limestone formation at about 85,000 years (Broecker and Thurber, 1965). After the emergence, a plant succession was initiated and weathering produced the solution pits. The amount of time involved in these events is unknown. From the time the pit in Nichol's Hammock was deep enough to trap animals, until it was destroyed in 1964, animals were probably being caught and deposited. Since only the top three feet of the material in the sampled pit was collected, it represents a more recent fauna than might have been collected at lower stratigraphic levels.

The presence of *Rattus* is often used as an indicator of post-Columbian time. No *Rattus* was collected from Nichol's Hammock

although the genus is known to occur in the area today (Blair, 1935). The absence of *Rattus* suggests pre-Columbian age for this material.

Among the specimens collected were very badly corroded pieces of iron. It was not until after the arrival of Europeans that such metal was used in Florida. This would place the deposition of at least part of the fauna in post-Columbian times.

All but two of the species found in the solution pit are still extant in southern Florida. The Florida wolf, *Canis niger* Bartram, is believed to have become extinct in Florida by 1900 A.D. This is the only animal which can be dated as pre-1900. This locality has yielded the first mainland specimen of *Neotoma floridana* (Ord) from South Florida. According to Sherman (1955), *Neotoma floridana smalli* Sherman is known only from the type locality on Key Largo, Monroe County, Florida. The next nearest records of *Neotoma* are of *Neotoma floridana floridana* (Ord) from Sebastian, Indian River County (Sherman, 1937) on the east coast and from Murdock, Charlotte County (Sherman, 1945) on the west coast of Florida. The record from Nichol's Hammock demonstrates that *Neotoma floridana* once ranged along the coastal rim area and now only a disjunct population is left on Key Largo. The time of the extermination of the mainland population is unknown, except that it was at least pre-1937, when Sherman recorded the range of *Neotoma floridana* on the east coast of Florida.

A dog, *Canis familiaris* Linnaeus, is also represented in the trap. This animal probably became trapped relatively recently, but it must be noted that *Canis familiaris* has been found in pre-Ceramic (5,000-3,500 years b.p.) Indian mounds in the state (Neill, Gut, and Brodkorb, 1956).

Canis niger is the only animal in the fauna which sets an upper age limit of 1900. The age of most of the "fossil fauna" is probably post-Columbian because of the occurrence of the pieces of iron in among the bones. Part of the fauna may be pre-Columbian, but there is no direct evidence for this assumption.

Geology and Physiography

Nichol's Hammock rests on the Miami Oölite, an oölitic limestone believed to have been formed during the Sangamon Interglacial (Cooke, 1945). This limestone forms a broad band running

along the southeastern part of the Florida peninsula from about West Palm Beach to Key West. The East Coast ridge is relatively high compared with the surrounding area, averaging about twelve feet above sea level. This ridge is broken into a series of islands of higher ground, separated by numerous sloughs or fingers of the Everglades.

The whole area has been drastically changed in the last fifty years by drainage projects which have turned the low areas, previously under water at least part of the year, into cultivated fields. However, these old prairie channels are still evident in the cultivated areas since they contain a rich black peat and muck soil which is in sharp contrast to the light-colored sandy soils of the higher areas.

Solution holes are common in the hammocks of southern Florida and wherever the limestone is exposed. They range in size from small cavities, giving the limestone a honey-combed appearance, to large, steep walled pits twenty or more feet across. These solution holes result from the action of carbonic acid and humus colloids from decaying vegetation, plus rain and ground water.

The limestone outcrops, so obvious in the hammocks, are not seen in the other habitats. In the pine flatwoods, which surround Nichol's Hammock, the solution holes are filled in and covered with sand. Thus, it is only in the hammocks that the pits are deep enough and remain open long enough to become traps.

Vertebrate Fauna

The minimum number of individuals is given for the mammals.

Class Mammalia

Didelphis marsupialis Linnaeus. Opossum. 13
Cryptotis parva (Say). Florida least shrew. 1
Tadarida brasiliensis (I. Geoffroy St. Hilaire) Mexican free-tailed bat. 1
Glaucomys volans (Linnaeus). Southern flying squirrel. 4
Sigmodon hispidus Say and Ord. Cotton rat. 6
Neotoma floridana (Ord). Florida woodrat. 1
Neofiber alleni True. Florida water rat. 2
Sylvilagus palustris (Bachman). Marsh rabbit. 1
Sylvilagus floridanus (Allen). Eastern cottontail rabbit. 1
Procyon lotor (Linnaeus). Raccoon. 5
Mephitis mephitis (Schreber). Striped skunk. 1
Spilogale putorius (Linnaeus). Spotted skunk. 2
Canis niger Bartram. Florida wolf. 1

Canis familiaris Linnaeus. Dog. 1
Odocoileus virginianus (Zimmerman). White-tailed deer. 5

Class AVES

Cathartes aura (Linnaeus). Turkey vulture.
Meleagris gallopavo Linnaeus. Wild turkey.
Zenaidura macroura (Linnaeus). Mourning dove.
Colinus virginianus (Linnaeus). Quail.
Corvus ossifragus Wilson. Fish crow.
Otus asio (Linnaeus). Screech owl.
Passeriformes. Passerine bird.
Ciconiiformes. Heron-like bird.

Class REPTILIA

Chelydra osceola Stejneger 1918. Snapping turtle.
Kinosternon subrubrum (Lacépède). Mud turtle.
Terrapene carolina (Linnaeus). Box turtle.
Chrysemys floridana (Le Conte). Cooter. For inclusion of *Pseudemys* in this genus see McDowell (1964).
Chrysemys nelsoni (Carr). Florida red-bellied turtle.
Deirochelys reticularia (Latreille). Chicken turtle.
Anolis carolinensis Voigt. Green anole.
Ophisaurus ventralis (Linnaeus). Eastern glass lizard.
Diadophis punctatus (Linnaeus). Ringneck snake.
Heterodon platyrhinos Latreille 1802. Hognose snake.
Coluber constrictor Linnaeus. Racer.
Opheodrys aestivus (Linnaeus). Rough green snake.
Drymarchon corais (Daubin). Indigo snake.
Elaphe gutatta (Linnaeus). Corn snake.
Natrix cyclopion (Dumeril, Bibron & Dumeril). Green water snake.
Thamnophis sauritus (Linnaeus). Ribbon snake.
Thamnophis sirtalis (Linnaeus). Garter snake.
Liodytes alleni Garman 1874. Swamp snake.
Micrurus fulvius (Linnaeus). Coral snake.
Crotalus adamanteus Beauvoie. Eastern diamondback rattlesnake.

Class AMPHIBIA

Amphiuma means Garden 1821. Amphiuma.
Bufo terrestris (Bonnaterre). Common American toad.
Hyla squirella Latreille. Squirrel treefrog.
Rana sp.

Class OSTEICHTHYES

Lepisosteus sp. Garfish.
Ictalurus sp. Catfish.

Discussion of the Mammalian Fauna

Thirty-five mammalian species presently live in southern Florida, excluding domesticated mammals. Of these, 13 were identified from Nichol's Hammock. Carnivora not identified in the solution pit include bobcat, cougar, bear, weasel, mink, fox, and otter. These mammals are now extremely rare in the southern part of the state owing to the pressures of civilization. Their density in the area surrounding Nichol's Hammock may not have been very great in the past, especially bear and cougar which have large home ranges. The five genera of bats occurring in South Florida are not likely candidates for preservation in this situation although one bat, *Tadarida brasiliensis,* is represented in the collections. Eight species of rodents found in the area today, but not found in the solution hole, are *Mus musculus* Linnaeus, *Rattus rattus* Linnaeus, *Rattus norwegicus* Berkenhaut, *Sciurus carolinensis* Gmelin, *Sciurus niger* Linnaeus, *Peromyscus gossypinus* (Le Conte), *Peromyscus floridanus* (Chapman), and *Oryzomys palustris* (Harlan). Two insectivores, *Blarina brevicauda* (Say) and *Scalopus aquaticus* (Linnaeus), are also missing from the collections. The exclusion of the smaller mammals does reflect a collecting bias since the smaller forms are represented by fewer individuals than the larger ones. They may be present but only represented in the many unidentifiable fragments of bone. Although these small mammals live in the vicinity, they may not have fallen into a pit of this type or they might have been able to climb up branches and vines hanging over the edge. Also, birds of prey may have fed upon them or removed the remains. This may also indicate that some of the small mammals are not as subject to becoming trapped as are others.

The minimum number of individuals of each species represented in the solution hole is given above. The most abundant mammal is *Didelphis marsupialis,* represented by twice as many individuals as any other species. The opossum, a scavenger, may have been attracted to the trap by the animals already in the pit. The same might have been true of the six genera of carnivorous mammals represented. This may also reflect the relative density of these mammals in the area surrounding the trap. The most common native rodent, *Sigmodon hispidus,* is represented by more individuals than any other rodent, as would be expected. The flying squirrel, *Glaucomys volans,* is the second most common rodent in

the pit although it does not appear to be very common in the area, perhaps a result of its nocturnal and arboreal habits. Flying squirrels are more likely to become trapped than other terrestrial rodents by gliding into the pit unaware of the difficulties of escape. Therefore, this large number of individuals might magnify the actual density of the flying squirrel population. Deer are common in most habitats in South Florida, but the population has been severely reduced in recent years by excessive hunting and by the invasion of human residents. A minimum of five individuals, including at least two bucks, of *Odocoileus virginianus* are represented from the pit. On the basis of their dentitions, the chronologic ages of the individuals range from immature to old adult. It is not that all the mammals in the collection Nichol's Hammock accidently fell into the pit; some may have lived in the pit, especially the smaller mammals such as *Cryptotis floridana* and *Tadarida brasiliensis*. It is also possible that the remains of the small mammals washed into the pit by the frequent torrential rains that flood the area for brief periods of time.

Most of the mammals from the solution hole are found in a variety of habitats at the present time, or are capable of widespread movements. *Odocoileus virginianus* is found very widely distributed and in numerous habitats (Harlow, 1959). *Sigmodon hispidus* is also found in a variety of habitats, including neglected fields, palmetto scrub, marshes, mangrove swamps, and most woodlands (Howell, 1943). *Sylvilagus palustris* is found in hammock, low pinelands, and in weed bordered ponds surrounded by open fields (Blair, 1935). *Sylvilagus floridanus* is found in the same terrain as *Sylvilagus palustris*, but occurs more often in the drier areas (Ivey, 1947). *Procyon lotor* and *Didelphis marsupialis* prefer mesic to hygric, but also get into xeric habitats. According to Jennings (1958), the distribution of *Tadarida brasiliensis* cannot be correlated with vegetation. Many colonies of *Tadarida* have abandoned natural roosts for man-made structures, and this genus may be found in all three major habitats. Howell (1960) found *Spilogale putorius* mainly in xeric situations, in palmetto scrub along the coast and in dry pine farther inland. *Glaucomys volans* is essentially a mesic animal in southern Florida. Sherman (1955) describes *Neotoma floridana smalli* Sherman as living in a mesic hammock situation on Key Largo. *Neotoma floridana floridana* (Ord)

is described by Pearson (1952) as inhabiting swamps, low hammocks, and high hammocks in the Gulf Hammock area, about 300 miles north of the area under discussion. It was not possible to determine the subspecies of the Nichol's Hammock specimen, which consists of a left mandible containing a badly worn M_1 and lacks the coronoid, articular, and angular processes.

Of the mammals found in the solution hole, only *Neofiber alleni* can be considered as a good habitat indicator. Its usual habitat is strictly hygric (Birkenholz, 1962) but at present there are no suitable habitats for this genus in the immediate vicinity. The inclusion of the Florida water rat in the solution hole outside its natural habitat might be the result of periodic flooding of the area, with drainage from the Everglades, before drainage control systems were constructed. Water would remain for longer periods of time in the solution holes than in the surrounding areas. *Neofiber alleni* may have been attracted to these pools and was trapped as the water receded.

The assemblage of bones from Nichol's Hammock represents the common and not-so-common mammals of the area. It would be expected that a trap, which was open for a long period of time, would contain a considerably higher percentage of the most common mammals of the area. The carnivores and large herbivores fit this expectation. However, even taking into account the difficulties of perservation, the small mammals (with the exception of *Sigmodon hispidus*) represent the rarer elements in the present mesic fauna. Many of the species that would be expected are absent. Although many explanations have been offered, the absence of taxa remains essentially fortuitous.

Ecology of the Herpetofauna

Of the 54 species of reptiles living on the mainland of southern Florida, 20 were collected in the solution hole in Nichol's Hammock. Of the 21 amphibians recorded from southern Florida, only four occur in the pit.

The principal division of habitats used here follows that proposed by Duellman and Schwartz (1958). They are xeric, mesic, alternohygric, and hygric. Xeric habitats are the dry areas of rosemary scrub, pine forest, and beaches. The hammocks comprise the mesic habitats in southern Florida. These are areas of woodland,

other than pine, and are of three kinds, oak hammock, cabbage palm hammock, and tropical hammock. The term alternohygric is applied to the environments subject to periodic flooding and drying. This habitat consists of cypress flats and wet prairies commonly called "Everglades". Hygric refers to the aquatic freshwater habitats found in sink ponds, cypress heads, canals, and rivers. The distribution of the species of reptiles and amphibians represented in Nichol's Hammock in the major habitats and their relative abundance in each habitat is given in Table 1.

TABLE 1
Major Habitats of Reptiles and Amphibians

Species	Xeric	Mesic	Alternohygric	Hygric
Chelydra osceola	—	—	M	A
Kinosternon subrubrum	—	—	M	A
Terrapene carolina	A	M	M	—
Pseudemys floridana	—	—	M	A
Pseudemys nelsoni	—	—	M	A
Deirochelys reticularis	—	—	—	M
Diadophis punctatus	M	A	R	—
Heterodon platyrhinos	M	—	—	—
Opheodrys aestivus	M	M	A	—
Drymarchon corais	M	A	M	—
Elaphe gutatta	A	M	R	—
Natrix cyclopion	—	—	M	A
Thamnophis sauritus	M	R	A	—
Thamnophis sirtalis	M	R	M	—
Liodytes alleni	—	—	A	—
Micrurus fulvius	M	A	—	—
Crotalus adamanteus	A	R	—	—
Anolis carolinensis	M	A	M	—
Ophisaurus ventralis	A	—	M	—
Amphiuma means	—	—	M	A
Bufo terrestris	A	M	M	—
Hyla squirella	M	M	A	—

A, abundant; M, moderately abundant; R, apparently rare.

Neither *Rana* nor *Coluber constrictor* were included in the table because the species of *Rana* and the subspecies of *Coluber constrictor* could not be determined.

Eight species of reptiles and two amphibians found in Nichol's Hammock occur in xeric, mesic, and alternohygric habitats. These

are *Terrapene carolina, Diadophis punctatus, Opheodrys aestivus, Drymarchon corais, Elaphe gutatta, Thamnophis sauritus, Thamnophis sirtalis, Anolis carolinensis; Bufo terrestris, Hyla squirella.*

These species are among the most abundant and widespread reptiles and amphibians in southern Florida. Almost half of the species identified from Nichol's Hammock are represented by the 10 species named above. The other 12 species found in the solution hole in Nichol's Hammock are either restricted to a particular habitat or are restricted from one or more habitats. These are the species which prove to be the best habitat indicators. Three species of reptiles reach their greatest abundance in mesic hammocks. They are *Diadophis punctatus, Drymarchon corais,* and *Anolis carolinensis. Drymarchon corais* is represented by five times as many vertebrae as any other snake, but the number of individuals is not known.

Three snakes are found in xeric habitats but not alternohygric or hygric. They are *Heterodon platyrhinos, Micrurus fulvius,* and *Crotalus adamanteus.* Of these, *Heterodon platyrhinos* is the only species not found in mesic hammocks. It prefers open areas of sandy soil with scattered pines. *Micrurus fulvius* is more abundant in hammocks, where it can find suitable cover, than in xeric situations. *Crotalus adamanteus* is found occasionally in mesophytic hammocks but is most abundant in pinewoods.

One lizard, *Ophisaurus ventralis,* occurs most abundantly in dry grassland or in pinewoods and is also found in alternohygric but not in mesic hammocks.

One amphibian and seven reptilian species inhabit wet prairie, cypress flats, and other aquatic situations, but do not range into xeric or mesic habitats. These species are *Chelydra osceola, Kinosternon subrubrum, Pseudemys floridana, Pseudemys nelsoni, Deirochelys reticularia, Natrix cyclopion, Liodytes alleni; Amphiuma means.*

A summary of the present distribution by habitat of the 22 species of reptiles and amphibians identified from Nichol's Hammock is as follows: xeric habitats, 14 species present, 8 species absent; mesic habitats, 12 species present, 10 species absent; alternohygric, 18 species present, 54 species absent; hygric, 7 species present, 15 species absent.

Ten species are present in xeric, mesic, and alternohygric. One

species is confined to the xeric habitat. Eight species are absent from xeric and mesic habitats. Three species are absent from alternohygric; one (*Deirochelys reticularia*) occurs only rarely in alternohygric.

Notable is not only the presence of certain reptiles but also their absence from the Nichol's Hammock collections. Reptiles absent from the pit are *Eumeces inexpectatus* Taylor, *Sphaerodactylus notatus* Baird, *Lygosoma laterale* Say, *Elaphe obsolata* (Say), *Lampropeltis getulus* Linnaeus, *Storeria dekayi* (Holbrook).

Eumeces, Lygosoma, Sphaerodactylus, and *Elaphe* are all abundant in mesic hammocks in southern Florida at the present time. *Sphaerodactylus notatus,* though abundant, is thought to be a relatively recent immigrant into South Florida.

Species abundant in xeric habitats, which surround Nichol's Hammock, but are not found in the collection from the solution hole are *Sceloporus woodi* Stejneger, *Ophisaurus compressus* Cope, *Cnemidophorus sexlineatus* (Linnaeus), *Eumeces agregius* (Baird), *Masticophis flagellum* (Shaw), *Tantilla coronata* Baird & Girard; *Scaphiopus holbrooki* (Harlan), *Hyla femoralis* Latreille, *Hyla gratiosa* LeConte.

For various reasons the absence of species is less easily explained than their presence. The species might never have been trapped, or the remains could have been overlookd in collecting, or possibly they could be among the many unidentifiable elements in the collection. It is very unlikely that all the species listed occupied the habitat surrounding the solution hole in Nichol's Hammock. For whatever reason, the explanation for absence of forms must remain speculation.

From the species discussed above and their known habitat preferences, one may conclude that the environment surrounding Nichol's Hammock was alternohygric. Considering the area today, this ecology does not seem possible, but as late as 50 to 100 years ago this area was probably alternohygric. About 0.4 miles from Nichol's Hammock are remnants of an old slough which must have drained the Everglades during periods of high water. It is likely that Nichol's Hammock also became flooded during these periods. When the water receded, the aquatic or semi-aquatic animals had to travel the 0.4 mile back to the slough or they crawled into the places that still contained water, namely the solution holes. As the

water went down farther, the animals became permanently trapped and their bones were deposited when they died. This would also explain the presence of the garfish, *Lepisosteus*, and the catfish, *Ictalurus*.

Summary and Conclusions

The solution pit in Nichol's Hammock was actively trapping animals until 1964. At least part of the fauna collected from the pit was deposited in post-Columbian times. It is assumed that the trap developed in and remained in a mesic habitat throughout its history since it is observed that solution holes are best developed in hammocks. The fauna of this pit, however, was not essentially a mesic fauna. Vertebrates from all the major habitats, including many forms from alternohygric situations, are represented. This may possibly be explained by the proximity of the drainage sloughs of the Everglades and periods of high water which probably inundated the area before drainage control systems were constructed.

Had this been a fossil fauna, with only the identified species available, one might conclude that the area of deposition was a more hygric situation, possibly a pond or swamp, whereas in reality it is an occasionally inundated mesic habitat surrounded by a xeric habitat.

The trap in Nichol's Hammock collected a representative sample of the fauna of the whole area, not just a mesic fauna. Some of the mesic forms which one would have expected to find in this Florida trap, were not included.

Literature Cited

Birkenholz, Dale E. 1963. A study of the life history and ecology of the round tailed muskrat (*Neofiber alleni* True) in north central Florida. Ecol. Monographs, vol. 33, no. 3, pp. 255-280.

Blair, W. Frank. 1935. Some mammals from southern Florida. Amer. Midland Nat., vol. 16, pp. 801-804.

———. 1936. The Florida marsh rabbit. Jour. Mamm., vol. 17, pp. 197-207.

Broecker, W. S., and Thurber, D. L. 1965. Uranium-series dating of corals and oolites from the Bahaman and Florida Key limestones. Science, vol. 149, pp. 59-60.

Cooke, C. Wythe. 1945. Geology of Florida. Florida Geol. Surv., Geol. Bull. 29.

Duellman, W. E., and Albert Schwartz. 1958. Amphibians and reptiles of southern Florida. Florida State Mus. Bull., vol. 3, no. 5, pp. 182-318.

HARLOW, RICHARD F. 1959. An evaluation of the white-tailed deer habitat in Florida. Bull. Florida Game and Fresh Water Fish Commission, no. 5, pp. 7-60.

HOWELL, ARTHUR H. 1943. Two new cotton rats from Florida. Proc. Biol. Soc. Washington, vol. 56, pp. 73-75.

———. 1960. Revision of the skunks of the genus *Spilogale*. N. Amer. Fauna, vol. 26, pp. 1-55, U. S. Dept. Agric.

IVEY, ROBERT D. 1947. The mammals, excluding bats, of Palm Valley, Florida. Thesis, University of Florida, pp. 1-127.

JENNINGS, WILLIAM L. 1958. The ecological distribution of bats in Florida. Thesis, University of Florida, pp. 1-119.

MCDOWELL, S. B. 1964. Parition of the genus *Clemmys* and related problems in the taxonomy of the aquatic Testudinidae. Proc. Zool. Soc. London, vol. 143, pp. 239-279.

NEILL, WILFRED T., H. JAMES GUT, AND PIERCE BRODKORB. 1956. Animal remains from four preceramic sites in Florida. Amer. Antiquity, vol. 21, no. 4, pp. 383-394.

PEARSON, PAUL G. 1952. Observations concerning the life history and ecology of the woodrat *Neotoma floridana floridana* (Ord). Jour. Mamm., vol. 33, no. 4, pp. 459-463.

SHERMAN, H. B. 1937. List of the recent wild land mammals of Florida. Proc. Florida Acad. Sci., vol. 1, pp. 102-128.

———. 1945. Recent literature and some new distribution records concerning Florida Mammals. Proc. Florida Acad. Sci., vol. 7, pp. 199-202.

———. 1957. Description of a new race of woodrat from Key Largo, Florida. Jour. Mamm., vol. 36, no. 1, pp. 113-120.

Department of Paleontology, University of California, Berkeley, California 94720.